THE ARABS AND THE KNOWLEDGE OF PRECIOUS STONES

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It is not known exactly when a person picked up for the first time an attractive piece of stone or bone or volcanic glass and used it as an ornament. Archaeological evidence shows that the interest in unusual and attractive stones began with early man. Prehistoric drawings show figures decorated with teeth from various animals and ornaments made from seashells, volcanic glass or just any coloured stone hammered down to a small size easy to wear. As men developed and civilizations were born, their knowledge of these stones began to develop too and they started differentiating between stones.

So what were the characteristics that differentiated what became to be known as "precious stones" from others, perhaps equally attractive and unusual, but not considered exclusive enough to be treasured as a precious stone?

- ○ First of all, there was *rarity*. Stones that were abundant and of common quality were not interesting. Only very fine pieces are suitable to be fashioned into gemstones, and these are rare.
- ○ Then there was *durability*. A stone had to be hard enough to endure the ravages of time without disintegrating or breaking or losing its original beauty and attractiveness.
- ○ But perhaps the most important criteria was *beauty*. Here colour played a major role, although size and shape were also important. Only in the case of diamond was the absolute lack of colour of the stone of major importance.

These three conditions are still valid today.

All civilizations valued precious stones. In Indian mythology, holy cities were described as having emerald pillars, ruby and diamond cupolas, sapphire crossroads, highways blazing with gems, and trees that carried precious stones instead of fruit.

All holy books mention precious stones. In the Torah, the breastplate of the High Priest of Judah was decorated with several precious stones, in fact twelve stones representing the twelve tribes of Israel.

In Christianity, the Heavenly City was described as being gem-encrusted also with twelve precious stones, which led some Christian writers around the 8th century to assign the twelve stones of the Heavenly City to the Twelve Apostles.

In the Qur'ān, only pearls (*lu'lu'*), rock crystal (*ballūr*), and ruby (*yāqūt*) are mentioned. The word *marǧān* is also mentioned, but it then referred to small pearls and not to coral, which nowadays is called *marǧān*. Several *ḥadīṯ*s mention also *zabarǧad* (peridot) which is a green stone that looks very much like emerald. It is found in St. John's Island (Ǧazīrat az-Zabarǧad) in Egypt. It is also reported that the Prophet wore a silver ring with a carnelian (*ᶜaqīq*) stone, with which he used to seal his letters to the different rulers.

The Arabs started writing on precious stones at least as early as the 8th century. The first study of gemstones started probably well before 300 BC, but the only surviving manuscript on the subject was written by a Greek author called Theophrastus around 300 BC. This book dealt with the supposedly magical powers of stones. After that, and until late in the 15th century, there was only a handful of Western authors who wrote on gemstones. It is worth noting here that these early books dealt mostly with the supposedly magical properties of gemstones. They were not scientific books, but rather a compilation of folklore and superstitions related to stones.

During this time, Arab scholars were not idle, and many wrote extensively on gemstones. In his bio-bibliography written in the 10th century, Ibn an-Nadīm mentions literally dozens of authors on the subject.

The most prolific one was a certain Ǧābir al-H̱iraqī, who wrote a series of books devoted to gemstones, such as "*Kitāb al-Aḥǧār al-awwal, K. al-Aḥǧār aṯ-ṯānī, K. al-Ǧawāhir al-kabīr, Rasā'il fī l-ḥaǧar, K. az-Zumurruda, K. al-ᶜAqīqa, K. al-Billawra* ("rock crystal"). Unfortunately neither the author nor his books are known to us today.

It could very well be that some of these apparently lost works are still lying undiscovered, as, it is estimated that there are about several million manuscripts, only a small part of which are catalogued and indexed.

The earliest Arabic lapidary, *i.e.* a book on precious stones, that is still extant, is the *K. Khawāṣṣ al-aḥǧār* of ᶜUṭārid b. Muḥammad al-Ḥāsib, dating from the 3rd/9th century, and dealing mostly with the magical properties of gemstones.

So what is a precious stone? With the exception of pearl, coral and few other organically produced materials, *i.e.* materials produced by living creatures, all gems are attractive, lustrous and bright minerals found in rocks.

Originally, the Greeks used to call rock crystal *krystallos*, because they believed that rock crystal was fossilized ice, that is, ice frozen so hard that it could never melt again. Nowadays, the word crystal means a mineral substance frozen into its solid state, with characteristic molecular patterns for each different mineral. Whether the stone is microscopic or several meters long, it is still the same material with the same attributes. The appellation "precious" and "semiprecious stones" is not valid from the point of view of gemmology, and is based primarily on the actual value of the stone. All beautiful stones suitable for wearing in a piece of jewellery or simply just worthy of being admired, should be called "precious stone".

As for the Arabs, they called gemstones *al-aḥǧār al-karīma*, meaning stones that are noble, valuable, expensive, rare and precious at the same time. The rarest and most valuable were also called *al-aḥǧār al-mulūkiyya,* or royal stones.

To study gemstones, we study many aspects: their family, chemical composition, crystallographic habit, hardness, colour range, specific gravity, and other scientific characteristics.

The hardness of a stone is an important factor in deciding its value. Of course, the hardness of a stone is also useful in differentiating between stones that are similar in appearance. To measure the hardness of a stone, we use what is called the Mohs scale of hardness. This scale was devised by the German scientist Friedrich Mohs in 1812, and depends on the fact that a harder material will scratch one that is softer, and where gemstones are classified from 1 (being the least hard stone, such as soapstone) to 10 (with diamond the only stone with this hardness). In the Mohs scale, the hardness from one level to another does not denote equal degrees. This means that diamond with a hardness of 10 is 140 times harder than ruby which has a hardness of 9, but 1000 times harder than quartz for example, with a hardness of 7, and hundreds of thousands of times harder than amber, with a hardness of 2.

When we look at this scale, we note that only those stones that have a hardness of 7 and above are the ones that are in fact the most precious and valuable stones. These include: a family of stones called beryl which includes the green emerald, the blue aquamarine, the pink morganite, and other coloured beryls; it also includes the yellow topaz, and another family of stones called corundum which includes ruby, sapphire, and all the other colours of sapphires, including pink, green, yellow, all shades of blue, and all shades of red; and finally, diamond. The only exception to the rule is pearl, which, far from being the romantic gem that women adore, is in fact an organic substance excreted by the pearl mollusc, to fight an intruder in its shell, and which has the hardness of 21/2 to 31/2 depending on its variety.

These stones that are considered nowadays as the most important ones are exactly those that the early Arabs valued most. As they conquered other lands and assimilated their cultures, they also acquired their tastes for beauty and luxury. Their love and admiration for precious stones was inherited from the Persians, Indians, and early Egyptians, with whom they had extensive commercial links. The Silk Road was not only about rich silks, precious woods, valuable spices and frankincense; it exposed the Arabs to the magnificent gems and jewellery of the neighbouring cultures.

Very soon, the Arabs competed with their neighbours, and we read in many books descriptions of the love of many caliphs for precious stones and beautiful jewellery, especially during the Umayyad, ᶜAbbāsid and Fāṭimid periods.

The Umayyad caliphs used to decorate their house utensils, bowls, dishes, etc. with precious stones, and used to wear jewels themselves, like all the ladies in their harem. One of the earliest caliphs, ᶜAbdalmalik b. Marwān (r. 685-705) owned a huge, and perfectly flawless spherical pearl called *al-yatīma*, "the orphan" because it could not be matched. It is also reported that many caliphs used to reward good poets by filling their mouth with as many jewels as it could take. Others used to change jewellery daily according to the clothes they wore.

Hārūn ar-Rašīd (r. 786-809), owned the famous ruby called "the mountain" which kings and rulers competed to buy for their own collections, and he had his name engraved on it.

Precious stones came from many different countries, including India, Sri Lanka, Iran, Afghanistan, Central Africa, Egypt, and other countries, but Baghdad was the market and showplace for the most expensive jewels. Extravagant pieces of jewellery were commissioned, like the Persian sapphire of about 1500 carats that was carved into the shape of a slave girl, or the life size palm trees that were made for the Persian H̱usraw and the ᶜAbbāsid caliph al-Muqtadir (r. 908-932), which were entirely of gold, and decorated with all sorts of gemstones, to imitate the bunches of dates hanging from the tree.

History books describe exceptional jewellery made to please the rulers, caliphs and viziers alike. The mother of the vizier Ǧaᶜfar al-Barmakī (767–803), for example, had an emerald crystal as long as an arm, with a bird made of ruby sitting on top. This long emerald rod was probably made of several emerald crystals joined together with metal threads. Another caliph owned a peacock of solid gold, its body completely covered with pearls and its eyes were two glowing rubies; as well as a deer of gold all studded with large and small pearls. Here again, these animals were apparently life-size.

Even carpets were woven from gold and silver and decorated with all kinds of precious stones. It is reported that one such carpet cost the astronomical sum of 130 million dirhams at that time. The caliphs' beds were also made of pure gold and studded with gems.

Weddings were the occasion to display magnificence and riches: On his wedding day to Būrān, the caliph al-Ma'mūn (813-833) gave her 1000 of the best rubies and a carpet woven entirely from gold, all decorated with pearls and rubies. On that occasion, he threw hundreds of pearls on the people attending his wedding. As did Būrān's grandmother the following night, as he went to his bride.

Fāṭimid rulers continued this tradition of luxury and love of precious stones, and many left behind crates filled with several kilograms of emeralds, pearls, and hundreds of drinking vessels made of bezoar, which is a secretion from the deer and was then considered to be a most precious stone, as it was seen as the most effective antidote against all kinds of poison. Bezoars were collected from all over and placed well guarded in the safe of the sultan, for use whenever necessary, either for the sultan himself, or for any other person in his domain. The crates and chests themselves, which were used to store these stones, were decorated with precious stones. Even the saddles of their horses were covered with gold and studded with all kinds of gems.

Later on, the Mamlūk rulers of Egypt also left immense treasures consisting of magnificent collections of the rarest and best of gemstones.

So, why is this insatiable love for precious gems? Of course, their value made them important in the eyes of the rulers, and the richer their treasury, the nobler and more important their reign was. Owning beautiful and rare things was also thrilling, and no doubt the beauty of a perfect pearl inspired many poets and satisfied many rulers.

But there was also another reason: Almost all gemstones were supposed to possess magical and medicinal properties.

The ancients believed that gemstones possessed magical properties if they were used properly; that is if they were engraved with the appropriate picture, if they were set during a specific time of the day that depended on the purpose wanted from the gemstone and on the gemstone itself; and if they were worn taking into consideration specific conditions required, such as what to eat or what not to eat, how to dress, and so on.

The general idea was that certain figures were engraved on specific stones during specific times of a specific day of the week, while certain planets were in particular houses. Often, special herbs or seeds or even the tongues of certain birds were also placed under the stone as it was set in gold, copper or more often silver or steel. This was enough to guarantee success of a mission, or to become knowledgeable of the secrets of the underworld, or to have special insight for locating treasures, or even to control the minds and deeds of people.

It was also believed that wearing pendants set with brilliant gems could attract the attention of the beholder and thus protect from the mysterious and dangerous evil eye, just like a lightning rod could divert the electric discharge.

Many gemstones were attributed specific magic and healing powers:

- Pearls were supposed to strengthen the optic nerves, regulate heartbeat; prevent heart attacks, chase away fear and anguish, stop haemorrhages, polish teeth and acted as a powerful antidote against poison.
- Rubies, sapphires and other corundums were believed to strengthen the self confidence of the wearer and his standing and respect amongst his people; prevent heart palpitations and recurrent anxieties; shield persons from lightning and stop haemorrhages and blood clotting.
- Emerald could improve eyesight, safeguard against epilepsy, cure stomach pains, repel poisonous animals, bring good luck and guard against evil.
- As for coral and turquoise, they also were beneficial for the eyes, protect children against the evil eye and evil spirits. Coral was especially effective against tooth decays and gum diseases; it was powdered and used for massaging the teeth and the gums.

The belief in the powers of precious stones did not die out with time. Today still, many people believe in the healing power of amber against gout and arthritis, the ability of turquoise to protect its wearer against the evil eye, the use of pearls as a calcium supplement. As a matter of fact, people in China, India and Japan powder pearls nowadays and swallow them as they provide a precious source of calcium. It is true, as the chemical composition of pearls is almost exclusively calcium carbonate, and as such, they do comprise a substantial amount of calcium.

Even dreams could be explained with precious stones. It is reported that a book dating back to the 8th century and written by a certain Aḥmad interpreted all kinds of dreams, based on Indian sources. If, for example a crown appeared to a king, this was supposed to bring increased power and success for the sovereign, but this depended on the colour and nature of the jewels that decorated the crown.

- If the gems were red and of the kind known as garnets or rubies, the dream indicated that the king would have great joy and good fortune and would be feared greatly by his enemies.
- If the stones were blue, this was a bad omen, and it meant that the king would probably lose part of his kingdom.

- ○ If the stones were light green, then this king would gain a great name in the world through his deeds, faith, and the greatness of his kingdom.

This idea of associating colour with certain moods, or diseases found some analogy between the colour of the gem and the character of the diseases to be cured.

Thus, yellow stones were supposed to be effective against jaundice, red stones, such as ruby, coral and carnelian could stop violent haemorrhages, the green emerald was regarded to be beneficial for the eyes, and one modern application of this belief is found in many of our modern hospitals, where the walls and the uniforms of the doctors are all green.

The interest in coloured stones was probably the reason why diamond was not considered to be the most important gemstone. As a matter of fact, until the 13th century, the Arabs valued pearl and ruby above all other stones. Diamond was mostly used for cutting and drilling stones, and also for killing people. We are told that diamond was hit until it was powdered, then it was mixed with salt or sugar. Whoever swallowed some of this powder with their food would soon die with terrible pains, as the tiny pointed crystals of diamond would tear at his intestines. Also, yellow-tinged diamonds were considered as more precious than colourless diamonds, for the same reason that colour was the most important criterion of beauty in a gemstone.

In addition to the well-known precious stones with which we are familiar nowadays, there were many stones that were also considered to be very valuable, either because of their exceptional properties, or simply because the legend and lore surrounding them conferred to their wearer unknown and mystical powers.

For example, al-Bīrūnī (973-1048) mentioned several stones, unknown to us nowadays, like the stone that could remove the hair from any part of the body if rubbed against it, the stone that could be used to make casts for broken bones, etc.

Other old Arab manuscripts mention a stone that could desalinate salty water and make it sweet, rain-making stones, stones that could turn a normal person into a deranged one and that could turn a deranged person into a normal one; stones that could counteract the poison of any poisonous creature, and so on.

The use of gemstones in healing and in medicine was largely documented by the Arab authors. However, their most important contributions to the field of gemmology were the scientific ones, especially those of al-Kindī, al-Bīrūnī, and at-Tīfāšī, which firmly established the roots of the science of gemmology.

In the 9th century, Yaᶜqūb b. Isḥāq al-Kindī wrote *Fī l-ǧawāhir wa-l-ašbāh*, or "On Gemstones and their Imitations". al-Kindī was the first one to mention that ruby (and the other corundums) was the heaviest of precious stones. He was also the first one to differentiate between spinel and ruby. As for pearls, al-Kindī was the first to point out the concentric nature of pearls, which, he said, grow layer over layer, like an onion, all made of mother-of-pearl, preceding the remarks of the French scientist Reaumur (1683-1757) by 900 years.

In the 10/11th century, al-Bīrūnī's contribution was even more substantial. In his book, *al-Ǧamāhir fī maᶜrifat al-ǧawāhir*, he covered all gemmological issues and mentioned all known gemstones. He referred to such scientific phenomena as double refraction in ruby and rock crystal, which was noted only in the 18th century in Europe, the dispersion test that he used to test diamond, which is no other than the same dispersion test we use nowadays, and which consists of checking whether the stone under examination shows splitting of the light into its rainbow colours, and other phenomena such as pyroelectricity which he described as the ability of tourmaline and amber to attract dust when heated.

He also listed the different colours of diamond, including white, silver, yellow, green, blue, red, and black. As a matter of fact, these colourful varieties of diamonds are considered some of the most valuable, and are called fancy diamonds. A very important piece of information given by al-Bīrūnī concerns the different cuts of stones. He described how to cut gemstones into different shapes, including the square and rectangular ones. But al-Bīrūnī's greatest contribution to the science of gemmology is undoubtedly the establishment of the Specific Gravity of stones, whereby he accurately calculated the Specific Gravity of many stones in order to ascertain their nature. His results were remarkably exact, and the modern calculations using computers are almost identical.

His scientific observations on gemstones probably laid the foundation of the science of gemmology, which, with at-Tīfāšī's work in the 13th century, became a firmly established science in the Arab and Islamic world.

Aḥmad b. Yūsuf at-Tīfāšī's *Azhār al-afkār fī ǧawāhir al-aḥǧār* or "Best thoughts on the best of stones" can truly be considered to be the first scientific book on gemstones, as the information therein is classified according to our modern concepts of gemmology, including colour, variety, chemical composition, crystal habit, hardness, specific gravity, locality, heat treatment, and so on.

at-Tīfāšī (d. 1253)

- ○ was the first one to establish a hardness scale for testing gemstones, preceding Friedrich Mohs by 500 years. If we compare the two scales, we note the great similarity between the hardness numbers allocated to the various gemstones in both scales. As a matter of fact, only two stones do not have matching hardness in these two scales.

- ○ He also described the cubic crystal habit of diamond. He also described cleavage, which is the weak spot in diamonds along which the stone could break, or which is actually used for cutting rough diamonds.
- ○ He also pointed out that ruby, sapphire and the other corundums all belonged to the same family. He also pointed out the types of inclusions – or impurities – in gemstones, and the way to treat some of them, which is the first reference to inclusions in gemmology.

Another important piece of information given in his book concerns the heat treatment of stones, specifically of ruby, for the purpose of improving the stone and thus making it more attractive and valuable. The heat treatment that at-Tīfāšī described in great detail is the first record of such an improvement method carried on gemstones, and it is still carried out today in India and Sri Lanka.

But there is even more puzzling information: For example, how could Aḥmad at-Tīfāšī ascertain in the 13th century that the beautiful blue colour of turquoise was due to the presence of copper? In Europe it was only in the 20th century that copper was discovered to be behind the beautiful colour of turquoise. And how did he discover that iron entered into the chemical composition of amethyst, although it is only in the 20th century, with the help of sophisticated electronic instruments, that scientists actually discovered that iron forms the basis of the chemical composition of amethyst. He was also the first one to differentiate between emerald and peridot (Arabic *zabarğad*), although the two stones are very similar in colour and were confused one for the other until then.

Through simple observation and modest experiments, the early Arab scientists were able to make discoveries and advance theories the accuracy of which amazes the modern gemmologist. There is no doubt that the genius of these early Arab scholars paved the way for our modern science of gemmology, just like their predecessors did for other sciences, such as astrology, astronomy, chemistry, algebra, and others.

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